Biotechnology:
Applications in Agriculture

Curriculum Guide: *Biotechnology: Applications in Agriculture*

Unit: III. Basic Laboratory Skills

Unit Objective:

Students will demonstrate a working understanding of the skills and considerations required to conduct laboratory experiments by creating a proposal for an experiment.

Show-Me Standards: 1.1, SC7

References:

Agriscience Handbook. National FFA Organization. (See an example cover sheet for a research proposal on p. 10.) Accessed March 30, 2004, from http://www.ffa.org/programs/ag_sci/documents/agsci_handbook.pdf.

Biology Lesson Plans (High School). Texas A&M University. Accessed August 11, 2003, from http://www.tamucc.edu/~eduweb/AppliedConnections/HSScience/biology.html.

Biotechnology: Applications in Agriculture. University of Missouri-Columbia, Instructional Materials Laboratory, 1998.

Science Fair Central. Discoveryschool.com. Accessed March 23, 2004, from http://school.discovery.com/sciencefaircentral/.

Science Fair Project on the Web. Accessed March 23, 2004, from http://sciencefairproject.virtualave.net/.

Scifair.org. The Society for Amateur Scientists. Accessed March 23, 2004, from http://www.scifair.org/.

Tutorials With Emphasis on Applicability to High School Chemistry. Chemistrycoach.com. Accessed August 11, 2003, from http://www.chemistrycoach.com/tutorials-9.htm.

Students may use additional outside sources to complete this activity.

Instructional Strategies/Activities:

- Students will engage in study questions in lessons 1 through 3.
- Students will complete AS 1.1, Using the Scientific Method; and AS 3.1, Using a Material Safety Data Sheet (MSDS).
- Additional activities that relate to the unit objective can be found under the heading "Other Activities" in the following locations: p. III-17 (1) and p. III-26 (1).

Performance-Based Assessment:

Students will work in groups of three to develop a written proposal for a scientific experiment. The proposal will include a statement of the problem, a list of materials and equipment, an outline of the procedure, and a list of safety measures to be taken or observed when conducting the lab work. Assessment will be based on the thoroughness, completeness, accuracy, and practicality of the proposed work. Other factors to be assessed will be grammar, spelling, punctuation, and capitalization.

Unit III—Basic Laboratory Skills
Instructor Guide

The instructor should assign the performance-based assessment activity at the beginning of the unit. Students will work toward completing the activity as they progress through the unit lessons. The assessment activity will be due at the completion of the unit.

1. Students will work in teams of three to identify an appropriate subject for a scientific laboratory experiment.

2. Experiment subjects may be derived from any legitimate field of science and do not need to be related to biotechnology. Students may develop their own ideas for an experiment subject, or the teacher may offer suggestions. Examples of practical experiment subjects include, but are not limited, to the following:
   - ❑ Do pH levels vary in different varieties of apples?
   - ❑ Do pH levels vary in different varieties of oranges?
   - ❑ Does the length of exposure to moisture affect popcorn popping rates?
   - ❑ Does the length of exposure to dry conditions affect popcorn popping rates?
   - ❑ Do water levels vary in different varieties of lettuce?
   - ❑ How is the freezing rate of water influenced by the water's initial temperature? For example, does hot water freeze sooner or later than cold water?
   - ❑ What amount and frequency of plant food application yields the largest blooms on a specific variety of rosebush?
   - ❑ Under specified conditions, how much water does a specific variety of houseplant absorb in a week?
   - ❑ How far do bees travel from their hives?
   - ❑ What natural substances kill mosquito larvae?
   - ❑ What are the effects of various temperatures on the behavior of a specific type of insect?
   - ❑ On what type of a surface does a snail move fastest?
   - ❑ How do pet mice respond to different types of food?
   - ❑ What color of bird feeder will attract the most birds?

3. After identifying an appropriate experiment subject, each team will write a proposal describing the design of the experiment.

4. Each team's proposal will include descriptions of the following elements:
   - ❑ A statement of the problem (NOTE: Each team is required to obtain approval of the problem from the teacher before proceeding with the proposal.)
   - ❑ A complete list of materials and equipment required to execute the proposed experiment
   - ❑ A detailed, step-by-step outline of the procedure to be used in conducting the experiment
   - ❑ A complete list of safety measures to be taken or observed when conducting the laboratory experiment

5. Students may use material in the unit and additional outside material to complete their proposals. Students may not use the source material word for word and must provide a complete bibliography of their sources along with their proposals.

6. Assessment will be based on the thoroughness, completeness, accuracy, and practicality of the proposal. Each of the four elements of the proposal will be examined according to those factors. Other factors to be considered in the assessment are grammar, spelling, punctuation, and capitalization.

Unit III—Basic Laboratory Skills
Student Handout

1. You will work in a team of three students to identify an appropriate subject for a scientific laboratory experiment.

2. After identifying an appropriate experiment subject, your team will write a proposal describing the design of the experiment.

3. Your team's proposal will include descriptions of the following elements:
   - ❑ A statement of the problem (NOTE: Your team is required to obtain approval of the problem from the teacher before proceeding with the proposal.)
   - ❑ A complete list of materials and equipment required to execute the proposed experiment
   - ❑ A detailed, step-by-step outline of the procedure to be used in conducting the experiment
   - ❑ A complete list of safety measures to be taken or observed when conducting the laboratory experiment

4. You may use material in the unit and additional outside material to complete the proposal. You may not use the source material word for word and must provide a complete bibliography of your sources along with your proposal.

5. Assessment will be based on the thoroughness, completeness, accuracy, and practicality of your proposal. Each of the four elements of the proposal will be examined according to those factors. Other factors to be considered in the assessment are grammar, spelling, punctuation, and capitalization.

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Unit III—Basic Laboratory Skills
Scoring Guide
Experiment Topic/Team Members _____

Assessment Area	Criteria	0 Points	1 Point	2 Points	3 Points	4 Points	Weight	Total
Statement of Problem	❑ Thorough ❑ Complete ❑ Accurate ❑ Practical	0 criteria met	1 criterion met	2 criteria met	3 criteria met	All 4 criteria met	X 5.625	
List of Materials and Equipment	❑ Thorough ❑ Complete ❑ Accurate ❑ Practical	0 criteria met	1 criterion met	2 criteria met	3 criteria met	All 4 criteria met	X 5.625	
Outline of Procedure	❑ Thorough ❑ Complete ❑ Accurate ❑ Practical	0 criteria met	1 criterion met	2 criteria met	3 criteria met	All 4 criteria met	X 5.625	
List of Safety Measures	❑ Thorough ❑ Complete ❑ Accurate ❑ Practical	0 criteria met	1 criterion met	2 criteria met	3 criteria met	All 4 criteria met	X 5.625	
Technical Considerations	❑ Spelling ❑ Grammar ❑ Punctuation ❑ Capitalization	0 criteria met	1 criterion met	2 criteria met	3 criteria met	All 4 criteria met	X 2.5	
TOTAL								

Final Assessment Total _____/100 pts.

Comments: